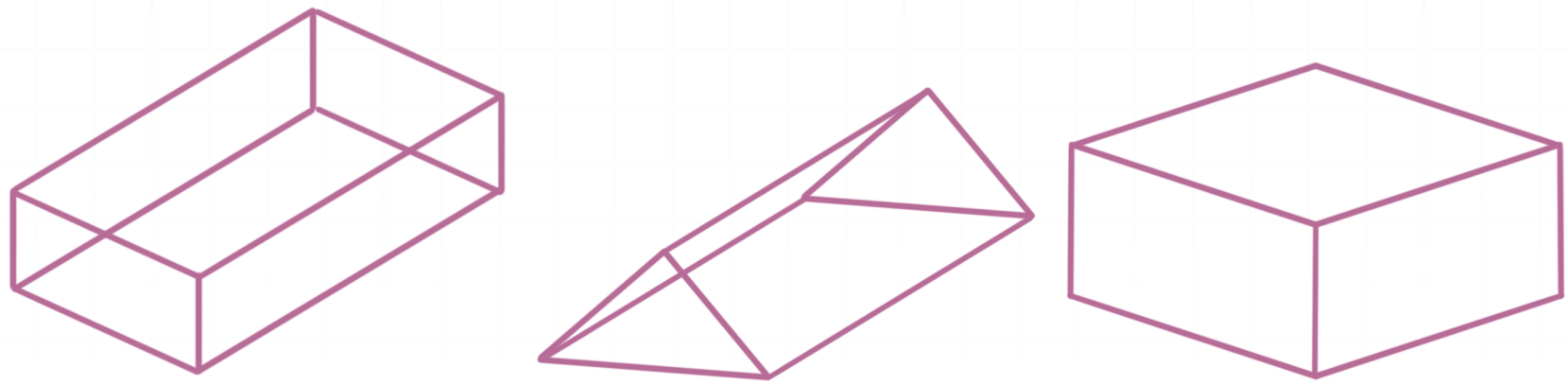
Nets/Volume/Surface area of prisms

In this lesson we'll look at an introduction to three-dimensional geometric figures, specifically nets, volume, and surface area of prisms.

Prism

A **prism** is a figure that has two congruent bases of any shape, and whose sides are made up of rectangles. Here are some examples of prisms:



The bases of a prism are the pairs of shapes that are congruent, and the height is the length that connects the two bases. In a rectangular prism, any two pairs of congruent rectangles that are connected by a height can be used as the bases.

Net

A **net** is the flattened out version of a three-dimensional shape. Here is a triangular prism (on the left) and its net (on the right).

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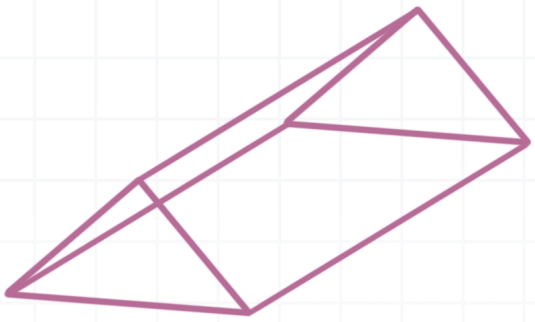

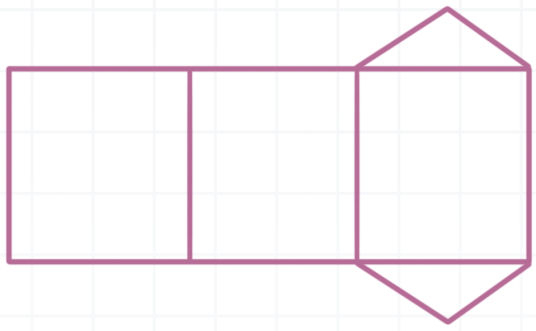

Surface area of a rectangular prism

You can also think of each side of a rectangular prism as a rectangle with a specific area, and the surface area of the prism is the sum of the area of all six sides.

The area of each side of the rectangular prism is given in the table:

Top and bottom	length x width
Left and right	width x height
Front and back	length x height

The formula for surface area of a rectangular prism is

$$A = 2lw + 2wh + 2lh$$

Surface area

To find the surface area of a prism, it can be helpful to sketch the net, find the area of each shape in the net, and then add the areas together. To find the surface area of this triangular prism, find the area of the three rectangles and two triangles in its net and add all the areas together.

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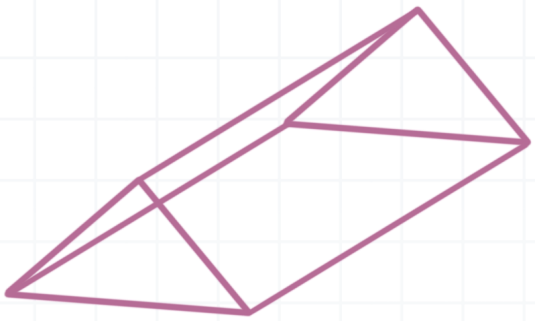
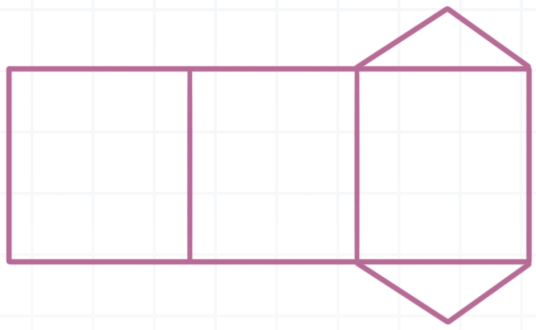
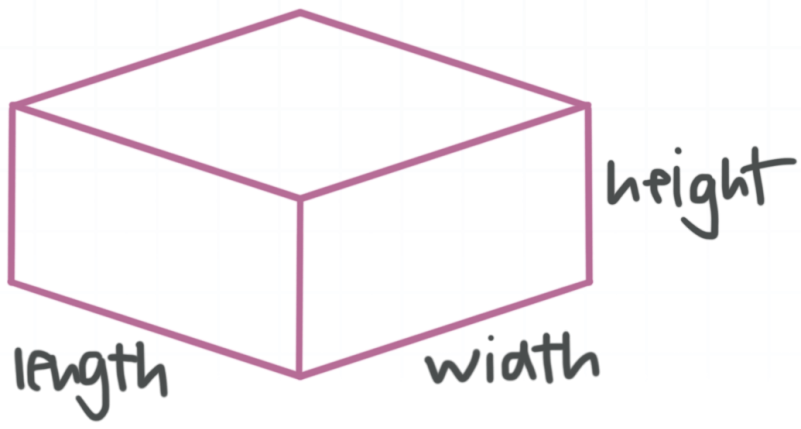




Volume of a rectangular prism

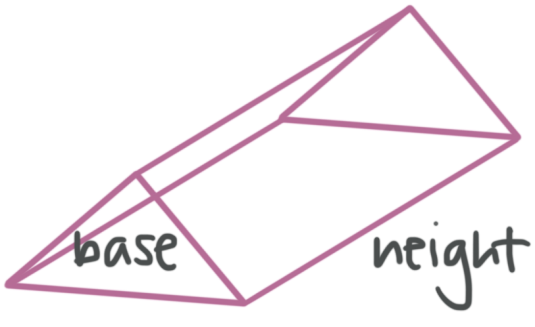
The volume of a rectangular prism is the length times the width times the height.



$$V = lwh$$

Volume of a prism

The volume of any prism is the area of the base times the height.



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$V =$ (area of base)(height)

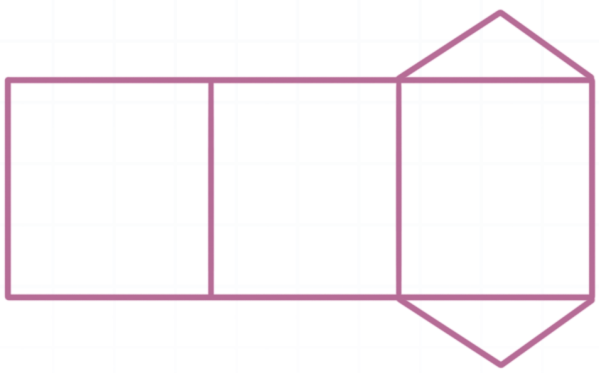
The volume of this triangular prism is the area of one of the triangles, multiplied by the length of the side that connects the two triangular bases.

Let's start by working through an example.

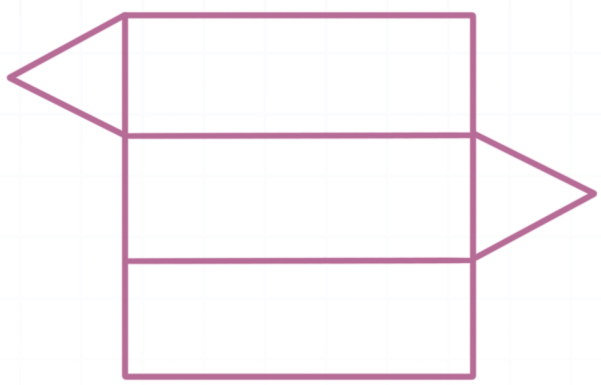
Example

Which net does not belong to a rectangular prism?

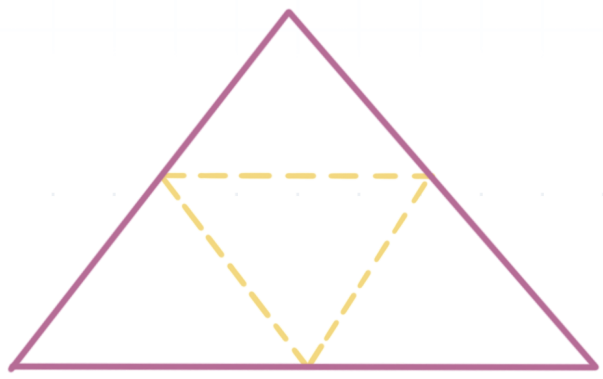
A.



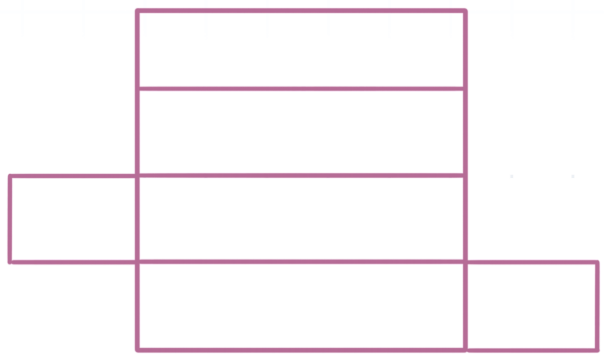
B.



C.



D.



Net C is the net of a triangular pyramid. All of the other nets are examples of prisms, because they have two congruent bases and the rest of the faces are rectangles.

Net A is a triangular prism with two triangular bases.

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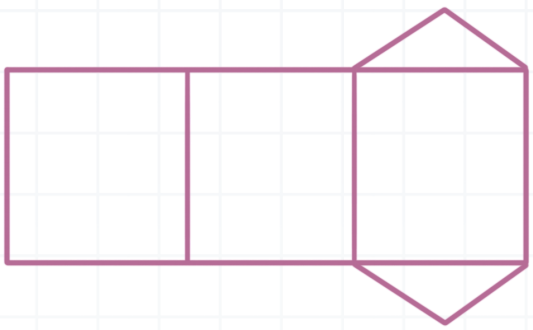
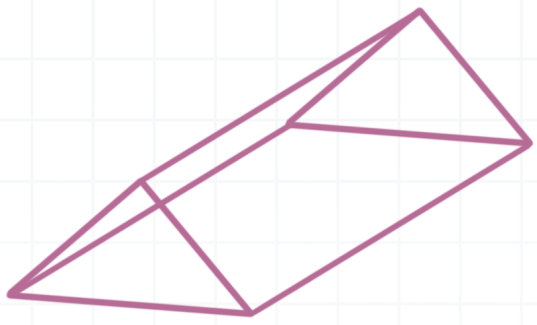
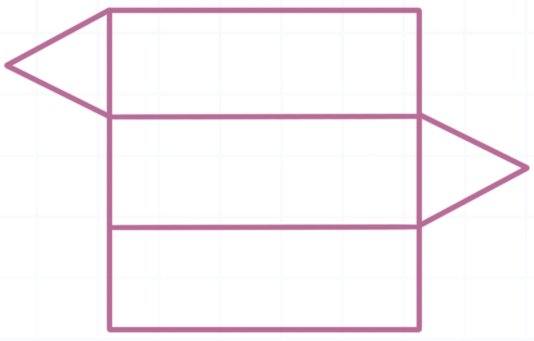
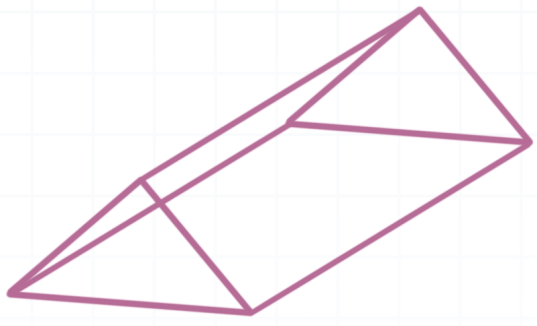


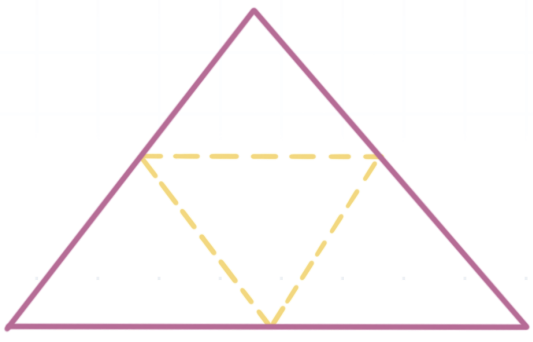


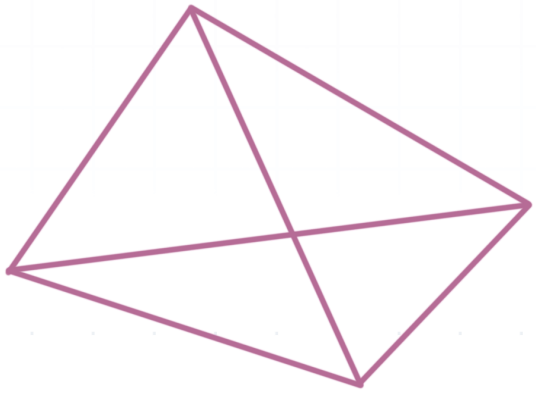
Net B is another example of a triangular prism.



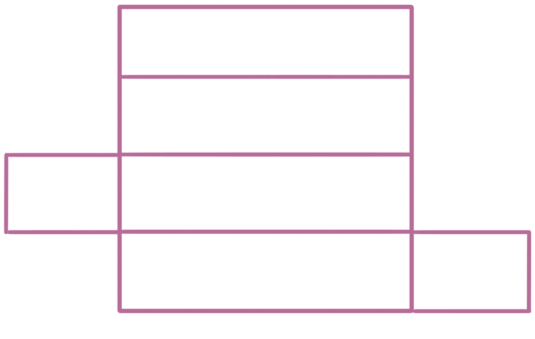


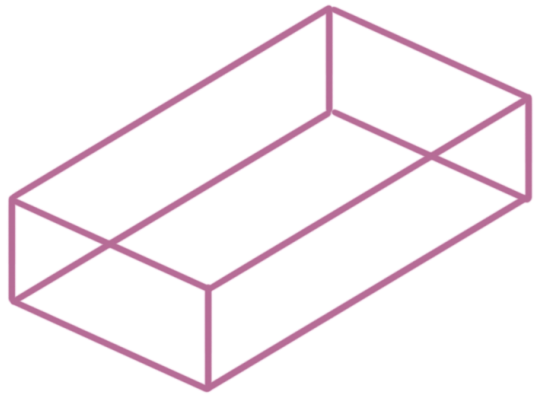
Net C is a triangular pyramid and not a prism.





Net D is a rectangular prism.





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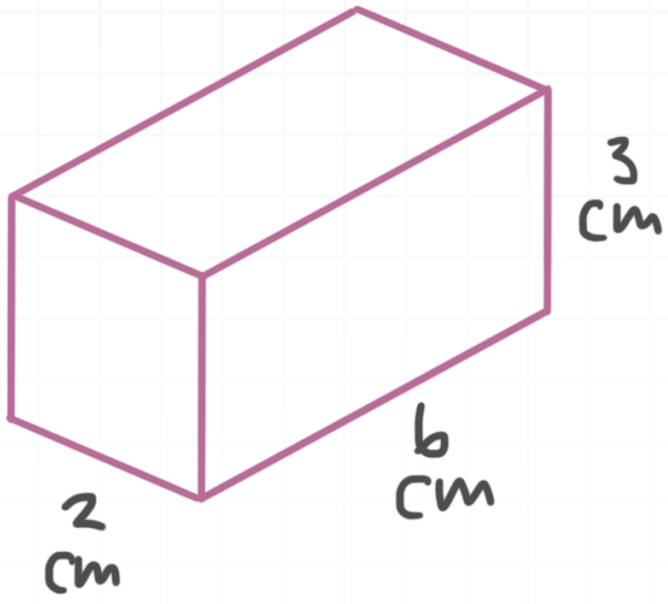
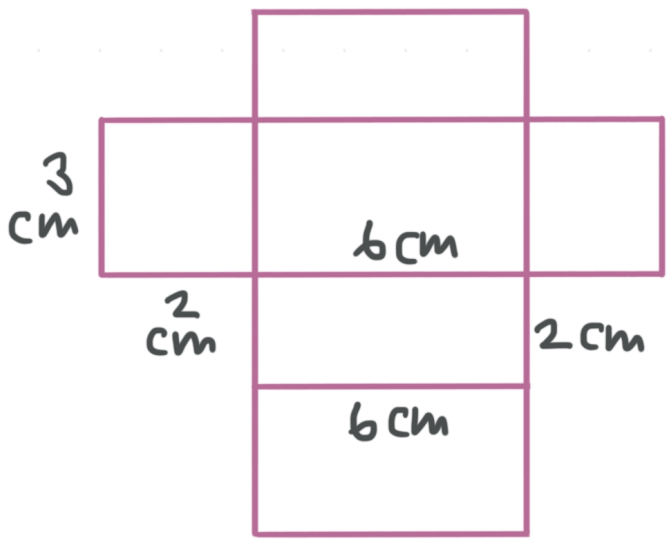
Let's do an example of surface area.

Example

What is the surface area of the figure?



It can be helpful to draw the net of the figure to calculate the surface area.



Now you can see we have three pairs of shapes. We can find the area of each and add them together. We have:

$$A = 2(2 \cdot 3) + 2(3 \cdot 6) + 2(2 \cdot 6)$$

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$$A = 2(6) + 2(18) + 2(12)$$

$$A = 12 + 36 + 24$$

$$A = 72 \text{ cm}^2$$

You can also think of the surface area of a rectangular box as the sum of the surface area of its six sides.

Top and bottom	length x width
Left and right	width x height
Front and back	length x height

We'll use the surface area formula.

$$A = 2lw + 2wh + 2lh$$

Plugging in the dimensions of the box we've been given, we get

$$A = 2(2 \cdot 3) + 2(3 \cdot 6) + 2(2 \cdot 6)$$

$$A = 2(6) + 2(18) + 2(12)$$

$$A = 12 + 36 + 24$$

$$A = 72 \text{ cm}^2$$

Which is what we got by drawing the net.

Let's do an example with volume.

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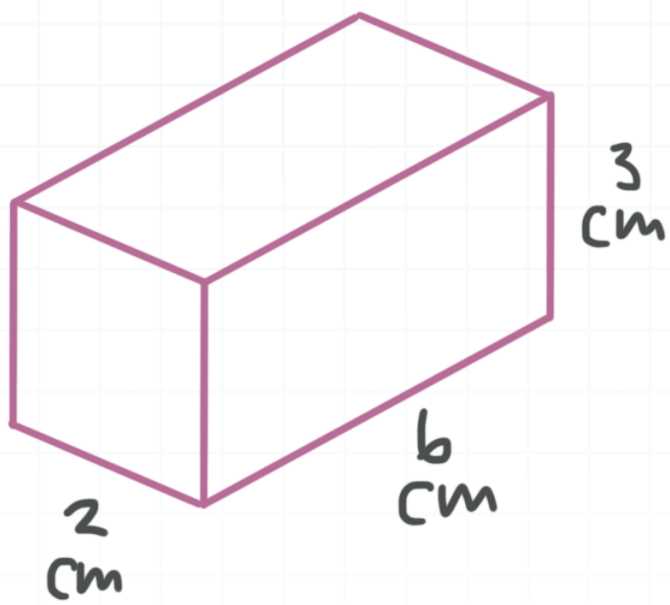
Example

What is the volume of the figure?



To find the volume of a rectangular prism, multiply the length, width, and height.

$$V = lwh$$

$$V = 2(6)(3)$$

$$V = 36 \text{ cm}^2$$

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